

Zero Retries issue 0021 2021-12-03

Advanced Amateur Radio - Data Communications; Space; Microwave... the fun stuff! The Universal Purpose of Ham Radio is to have fun messing around with radios - Bob Witte K0NR. Ultimately, amateur radio must prove that it is useful for society - Dr. Karl Meinzer DJ4ZC. We are confronted by insurmountable opportunities! - Pogo. Nothing great has ever been accomplished without irrational exuberance - Tom Evslin. Irrational exuberance is pretty much the business model of Zero Retries Newsletter - Steve Stroh N8GNJ.

Steve Stroh N8GNJ, Editor

Jack Stroh, Late Night Assistant Editor

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Request to Send

Hamvention *Ho!*

In a mere 24 weeks, in warmer weather and hopefully less rain, I hope to attend [Hamvention](#) 2022 - May 20-22, in Xenia Ohio. This one will be different as it will involve a cross-country car trip for wife Tina KD7WSF and I, which has been deferred for more than two years (darn pandemic) since we both semi-retired. The \$\$\$ hotel reservation is made, and out of equal parts confidence and optimism, I've bought a Hamvention ticket.

I'm really looking forward to Hamvention's flea market and seeing unique and amazing things there. When I first began attending Hamvention regularly, my joke was that I saw at least one of every piece of hardware I had ever touched in my electronics / Information Technology career. I'll bring an ample supply of \$20 bills for those cash only deals in the flea market. *This* time, especially since the space in our minivan affords it, I'll be bringing my boots - that first Xenia Hamvention flea market was woefully unprepared for rain and resulting ankle-deep mud. I've read that they have improved the flea market's drainage... but I'm still bringing the boots.

I debated whether to try to get a ~~table~~ booth (Hamvention doesn't offer mere tables...) at Hamvention to talk up and show off Zero Retries, but in the end since Zero Retries is still (as I write this in late 2021) in the "passion project" stage, it will be more fun, and useful to Zero Retries not to be tied down to a booth. I'll continue to talk up Hamvention in the coming months, and hope to meet up with Zero Retries readers that are also attending Hamvention. Perhaps we'll choose a specific restaurant to gather at, reminiscent of the old TAPR parties on Friday night at a Dayton barbecue joint.

It's fun to have Hamvention 2022 to look forward to!

Satellites, Satellites, Satellites, Satellites, and... Satellites

I thought I had one satellite story for this issue, which I initially put into ZR > BEACON, but when one brief satellite story became ~~four~~ five brief stories about satellites, that merited its own article.

New QO-100 antennas for DP0GVN in Antarctica



Photo Courtesy of AMSAT-DL

This photo was posted on the [AMSAT Deutschland Facebook Page](#) with this explanation

The MALIK ARCTICA Cargo Ship is on its way to antarctica Neumayer-Station III with our new QO-100 antenna for DP0GVN.

The previous QO-100 antenna for [Neumayer-Station III](#) was [destroyed by high winds](#), despite also being protected by a radome like these two antennas. DP0GVN has plans for a [lot of activity via QO-100](#) this coming season. To me, it speaks volumes about QO-100 that it can be accessed from *Antarctica*! Not to mention the power of Antarctic winds!

TinyGS Open Source Network of Satellite Ground Station Receivers

[TinyGS](#) is an open network of Ground Stations distributed around the world to receive and operate LoRa satellites, weather probes and other flying objects, using cheap and versatile modules.

This project is based on ESP32 boards and currently it is compatible with sx126x and sx127x LoRa modules but we plan to support more radio modules in the future.

I wouldn't have guessed that there's room for two open source, amateur (as in non-professional, not Amateur Radio) network of satellite ground station receive stations. (The other is [SatNOGS](#).)

AMSAT CubeSatSim PCB

[With this set of three printed circuit boards \(PCBs\)](#), you can build your own CubeSatSim! The CubeSatSim is a low cost satellite emulator that runs on solar panels and batteries, transmits UHF radio telemetry, has a 3D printed frame, and can be extended by additional sensors and modules. It is perfect for the classroom or for public demonstrations. In order to build a CubeSatSim, you will need to purchase the parts listed in the bill of materials (see below) and follow the instructions on the Github project page. All of the necessary surface mount components are already installed. The rest of the soldering is all through hole components.

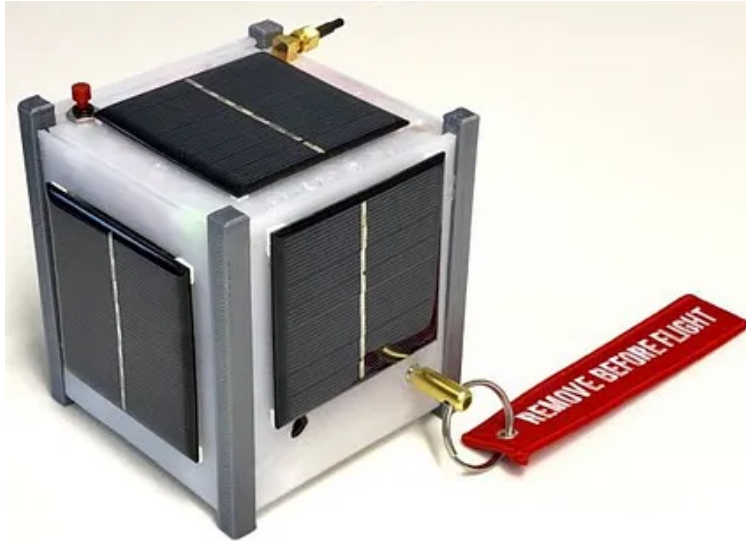


Image courtesy of Hackaday.com

The CubeSatSim has been out there for years, but news to me was that the components were available to anyone. I had the apparently mistaken impression that the components were intended for “official” AMSAT demonstrations such as representing AMSAT at hamfests, not just to anyone who thinks it would be cool to build their own simulated Amateur Radio CubeSat. The kit of 3 PCBs is only \$35, and you source the remaining components such as battery, Raspberry Pi Zero, etc. This is... just... cool. I *really* don’t need any more projects, but this one is compelling, so visual, and of course you need to fabricate some 3D printed components. Thus, I think I just found the first longer-term group project for the Bellingham Makerspace Amateur Radio Group, and my order is submitted to AMSAT two weeks ago (with no followup).

AmbaSat - Build your own Spacecraft and launch it into Space



Image courtesy of AmbaSat Ltd.

[The AmbaSat-1 Satellite Kit](#) delivers accessible space exploration to everyone by offering an affordable satellite development kit and rocket launch programme.

The AmbaSat-1 satellite is a tiny spacecraft measuring 35 mm square and just a few millimetres thick.

It’s got solar cells, a radio, gyroscope and accelerometer as well as several environmental sensor options.

The Low Earth Orbit satellite transmits data to over ten thousand Earth-based radio receivers which are spread around the whole globe. No specialist radio receiving equipment is required and data received from the satellite appears over the internet directly to your web-based Dashboard.

Your satellite will travel into space inside a CubeSat which holds an additional 200 AmbaSat-1 satellites.

Once in Low Earth Orbit our ground station will issue the ‘deploy’ command to release the AmbaSats into space, where they will become free-flying spacecraft.

Your satellite will then power itself using its bank of solar cells and you will start to receive data to your AmbaSat Dashboard.

Yes, this is real. You build and program a satellite (defined here as an independent device in orbit, that generates power, gathers data from sensors, and transmits data back to earth), return it to AmbaSat, and theoretically, it finds its way into orbit. Very, *very* cool!

Open Research Institute has made some [casual mentions on Twitter](#) about creating a customized version of AmbaSat-1 (the design is open source) that will transmit in the Amateur Radio 420 - 450 MHz band (that’s the US version of the band - other countries have different versions). I haven’t been able to find any details from ORI of this modification to the radio system to date.

PCSAT Still Going

Bob Bruninga WB4APR [reports](#):

For what it's worth, since the Russian space littering event, I am getting almost daily close approach alerts on PCSAT (is a high orbit, originally 800 km high). Alert miss-distances seem to be on the order of 200 to 500 meters.

Another day in space (after 20 years for PCSAT Semi-operational: <http://aprs.org/pcsat.html>)

Live downlink (W3ADO-1):

<http://www1.findu.com/cgi-bin/pcsat.cgi>

One minute serial nos (T#xxx), suggest a wake from 1 to 8 minutes per orbit. PCSAT is unique in that it has no CPU or Operating system. It is just two off-the-shelf KPC9612 TNC's (chips in sockets, etc) and uses their built-in sysop features for telemetry, command and control.

I remember reading about PCSAT when it was launched. It didn't dawn on me that PCSAT would be... *could be* even semi-operational after 20 years. Kudos WB4APR!

AREDN Updates (extracted from Facebook)

For those that aren't familiar with [Amateur Radio Emergency Data Network \(AREDN\)](#), it is replacement firmware for Wi-Fi and Wireless Internet Service Provider (WISP) units that add "Amateur Radio" features to those units, including the ability to use portions of spectrum near 2.4 GHz and 5.8 GHz that are unique to Amateur Radio. More information at [AREDN Advantage](#).

There are many features that are included with an AREDN unit, but the primary feature (to me) is that AREDN units that are on the same frequency, or connected to a smart router, automatically configure themselves into a mesh network. This makes deploying microwave networks much easier since the configuration is automatic - assigning IP addresses, routing, etc.

One of the reasons I maintain a presence on Facebook is that there is a lot of (what I perceive as valuable) information on Facebook that isn't present anywhere else. That's the case with the info I'll present here. Orv Beach W6BI is an [AREDN Ambassador](#) and as such has tight connections to the AREDN developers. There's a lot going on with AREDN that W6BI is reporting out in the [AREDN group](#) on Facebook and in the [AREDN Forums](#). What follows are some abstracts of the items that W6BI has mentioned on Facebook in the last few months. Click the link in the date to see the full article. (I tested this in "Private Browser" mode, and it seems to work even if you're not a Facebook user, though Facebook may annoy you with "Please log in" prompts, which can be dismissed.)

[2021-09-29](#) Ubiquiti (and other vendors) have scaled down their production of 802.11n products in favor of the newer 802.11ac products. That's making it harder to find AREDN-supported devices.

Those 802.11ac products bring improvements to the wireless protocol. A number of those improvements are of no use to the ham radio networking community (e.g., 80 MHz channels), but being able to run AREDN on those newer products ensures that we'll have products to deploy in our networks as the older 802.11n gear is phased out.

The AREDN developers have plans to migrate their codebase to the newer 802.11ac products and a number of you have been asking when that might be?

See [2021-11-27 update below](#).

[2021-10-06](#) It's been about a month since we deployed a version of the AREDN software with a patch designed to mitigate network routing storms across the SoCal network. Developed by Tim KN6PLV, the patch is actually pretty benign; it just makes OLSR, the routing daemon, somewhat smarter about recognizing storms and suppressing them. Think of it as a vaccine for the network.

[2021-10-18](#) It's Linktober! "Meshoween" is coming

We've found that as networks grow both in node count and complexity, it's almost inevitable that they'll suffer from a packet storm eventually. Now that the patch for mitigating those network packet storms has been rolled into an AREDN nightly build, we've decided that it's time to stress-test our network. On October 30th (starting at say, 9 a.m. local time) we'll attempt to link as many networks together to see how the network behaves. If you have a long-haul tunnel that you can bring up, feel free to do so.

The results of this network stress test were reported in an article on the AREDN web page - [Report on Meshoween 2021 network test](#).

As we hoped, network storms never appeared from our West Coast point of view, and none have been reported to date. Network traffic was not substantially higher than normal. Using KN6PLV's Mesh Monitor, messages per second were averaging about 600 before the test. During the test it hovered closer to 700. Most of the increase in traffic was due to OLSR routing broadcasts, which each node has to handle. As we expected, older devices struggled. Many wound up with a load significantly greater than 1 (which is a full load for a single-CPU device like these), indicating their CPUs were struggling to keep up with their pending processes. Ssh'ing into a few of them and running top showed that with node counts around 1,000, loads of around 4-5 were seen.

[2021-11-09](#) Long-standing AREDN bug squashed

Many of you have seen the long-standing issue of an AREDN node upon rebooting, broadcasting only its IP address rather than hostname plus IP address. It's far more common with newer hardware with faster CPUs than older gear. An OLSR restart via the Advanced Configuration tab would fix it, but it was really annoying. It was suspected to be a timing issue but was never resolved - until now.

New AREDN coder KN6PLV with guidance from AREDN Dev AE6XE, ably assisted by fearless beta tester K6CCC, went through a couple of iterations of code before squashing this bug completely. So if you have a newer piece of hardware that exhibits this bug, nightly build 648, or any later build, is for you!

Go forth and patch!

[2021-11-18](#) The AREDN web UI (User Interface) was written in Perl back when hmmm (high speed multimedia) was brought to life by, among other groups, the Broadband-Hamnet team. AREDN inherited that code when they came into being. Since then, the UI has evolved a bit, but still in the Perl programming language which while useful, is starting to show its age. Recently a project was started to modernize that UI in a more efficient language framework (Lua + Vue.js/Nuxt) with a more usable interface.

[2021-11-27](#) AREDN DEVELOPMENT STATUS

Progress is ongoing in the AREDN development arena. There are four substantial projects being worked in parallel:

1. Removal of the Perl software language, to be replaced with more modern and appropriate languages. When completed it will result in lighter weight, more responsive software.

2. Modernizing the user interface.
 3. AREDN being rebased to OpenWrt 21.02, which includes a LOT of changes.
 4. Support for 802.11ac devices (which arrived in OpenWrt 21.02). The first two devices being targeted for support by AREDN are the Nanobeam 5ac Gen2 and the Nanostation 5ac. After those are converted, the other 802.11ac devices targeted for support will follow in fairly short order. However, to get that accomplished a lot of code has to be rearranged, device definitions are changing, plus the software needs to be able to (eventually) accommodate more than one wireless port (!)
- Look for these changes to appear in incremental nightly builds over the next couple of months.

Meshing AREDN Nodes with an Ethernet Switch (Local - not Tunneling)

Thinking ahead to “antenna season” next Spring, I was imagining having two AREDN nodes, one inside my Faraday cage of a shop (metal sides, roof, doors) and one as a semi-directional node to another node near me. I thought that they would auto-discover each other via Ethernet, but then thought to ask Orv Beach W6BI, the Obi-Wan of AREDN:

When you have two AREDN nodes, say an inside node and an outside node, if you connect them to an Ethernet switch... do they auto-discover each other and add each other to the other's mesh list? I would think so, but I don't recall seeing that stated.

Obi-Wan replied:

Yes, with a small caveat - AREDN nodes talk to each other over Ethernet via the DtD (Device to Device) protocol, which uses VLAN 2. Technically a 'dumb' Ethernet switch doesn't know anything about VLANs, and early switches in fact either dropped VLAN tagged packets, or mangled them and passed them along. Modern 'dumb' switches are substantially smarter and pretty much all recent ones will pass VLAN traffic. Just be aware of that. The hot setup is to buy a POE-enabled switch, so you don't have to deal with an inline POE injector for your external node(s). Additionally most of them are smart enough to have a web-based UI, and via that you can power-cycle a node remotely.

I'm glad I asked!

ZR > BEACON

- [Doing “data stuff” over VHF/UHF FM?](#) Good article from Hudson Valley Digital Network (HVDN) about doing Amateur Radio data with a (Android) smartphone.
First, let me set up a user scenario so this makes sense as to what problem is being solved. Imagine you are somewhere where you have a fully charged smartphone, but no network access of any kind along with a dual band handheld amateur radio. Aside from the above, you happen to have some type of HF radio with you, but you forgot a few important things at home like a Morse code keyer and some important thing that prevents you from powering your HF radio, like a power cord, fuse, etc. Your only method of outside field communications is with your handheld radio now!

Feedback Loop

- **John Hays K7VE on Zero Retries 0020:**
The BCM-220 radio also can do the data sub-band at 219 - 220 MHz. Unfortunately it doesn't pass the [required channel size of] 100 KHz in that segment.
K7VE - Thanks for that additional info about the BCM-220 radio. We really ought to try to do *something* with 219 - 220 MHz! I wonder if there's anyone who could adapt the (open source) [New Packet Radio modem](#) from 420 - 450 MHz to 219 - 220 MHz. NPR would maintain the “letter of the regs” channel size of 100 kHz.

Amateur Radio Data Communications Orgs and Events

I'll try to maintain a list of organizations and events that specialize in data communications in Amateur Radio. Very generally (and highly subjectively), this listing is intended for organizations and events that one can join and (theoretically) meet up in person. Please let me know of others.

- [Join TAPR](#) - Supporting TAPR is a “vote with your wallet” for more data communications in Amateur Radio.
- [Amateur Radio Research and Development Corp. - AMRAD](#) - McLean, Virginia
- [ARRL Michigan Section Digital Radio Group](#) - Michigan.
- [Digital Communications Conference](#) - rotates West, Central, East US (generally in September)
- [Hudson Valley Digital Network](#) - Upstate New York (I think - they don't say.)
- [MicroHAMS Digital Conference](#) - Redmond, Washington (generally in March)
- [Mount Baker Amateur Radio Club Digital Group](#) - Bellingham, Washington.
- [Packet Radio User's Group](#) - Japan
- [Utah Digital Communications Conference](#) - Salt Lake City, Utah.

After this list gets fleshed out, I'll probably only feature it monthly or so.

Contributors This Issue

- My ongoing thanks to pseudostaffers [Dan Romanchik KB6NU](#), [Jeff Davis KE9V](#), and [Steve Lampereur KB9MWR](#) for continuing to spot, and write about “Zero Retries Interesting” type items, on their respective blogs, from Amateur Radio and beyond, that I don’t spot on my own. In this issue, KE9V pointed out the item on PCSAT.
 - My thanks for Orv Beach W6BI for keeping us AREDN dilettantes informed about AREDN via the AREDN Facebook Group. See *AREDN Updates (extracted from Facebook)* above.
-

Join the *Fun* on Amateur Radio

If you’re not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, here are some pointers:

- **Ham Radio for Dummies** by Ward Silver N0AX is now in its [4th edition](#). N0AX is a gifted writer, and HRFD is a great overview of Amateur Radio.
- My favorite YouTube channel for a good overview of Amateur Radio, the one I recommend is **AmateurLogic.TV**. [These folks](#) just seem to have so much fun!
- Dan Romanchik KB6NU offers [free PDF versions](#) of his *great No-Nonsense Study Guides*.
- [HamExam.org Amateur Radio Practice Exams](#) offers good **Flash Card and Practice Exams**.
- When you’re ready to take an **Amateur Radio examination** (Tech, General, or Extra), W1MX - The MIT Amateur Radio Society offers [remote exams](#), free for students and youngsters. *There are apparently many other remote exam options*.

And, *bonus* - with an Amateur Radio license, you’ll be [more attractive on dates](#) 😊

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More bits from Steve Stroh N8GNJ:

- [SuperPacket blog](#) - *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*
- [N8GNJ blog](#) - *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs - Bellingham, Washington, USA*

Thanks for reading!
Steve Stroh N8GNJ
Bellingham, Washington, USA
2021-12-03

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Below is a much more complete “footer” that has evolved over 30+ issues of ZR.

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Closing the Channel

- In its mission to grow Amateur Radio and make it more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to anyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex!
- My ongoing Thanks to Tina Stroh KD7WSF for, well, *everything* and Bill Vodall W7NWP as *Zero Retries Instigator in Chief*.
- My ongoing Thanks to pseudostaffers [Dan Romanchik KB6NU](#) and [Jeff Davis KE9V](#) for continuing to spot, and write about "Zero Retries Interesting" type items, on their respective blogs, from Amateur Radio and beyond, that I don't spot on my own.
- [Southgate Amateur Radio News](#) consistently surfaces "Zero Retries Interesting" stories.
- The [Substack email publishing platform](#) makes Zero Retries possible. I recommend it for publishing newsletters.

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Thanks for reading!

Steve Stroh N8GNJ (He / Him)

These bits were handcrafted in beautiful Bellingham, Washington, USA

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